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EDITORIAL

RECENT EVOLUTION OF THE PRACTICE OF RADIOLOGY IN CANADA*

Radiology is a medical specialty which is changing and progressing steadily. The increasing usefulness of radiological procedures, both in the diagnosis and treatment of diseases, has been responsible over the last decade for a sharp increase in the demand for radiological services in Canada. Modifications have occurred in the practice of radiology. Many radiologists gradually realized that it was becoming increasingly difficult for one individual to master both branches of radiology, to practice them equally well and, at the same time, to keep abreast with the advances in their specialty. Consequently, from a practical standpoint our specialty has in general divided into two separate fields, namely diagnostic or therapeutic radiology. The number of trainees aiming at certification in both fields is decreasing all the time. Very few of those who have already been certified in both branches of radiology actually practise both; the majority tend to devote more time and effort to diagnostic problems than to radiation therapy.

Special radiological examinations have developed greatly over the past few years and are rapidly becoming indispensable tools amongst various diagnostic methods. Such diagnostic procedures as tomography, angiography, angiocardiography and others, are requested more and more, requiring increasing knowledge, skill and time. Image intensifiers are presently attracting considerable interest.

Therapeutic radiology has shown a definite trend to centralization of treatment facilities mostly in cancer treatment centres which are often separate from general hospitals. A broad spectrum of sources of ionizing radiation is now available and necessary to radiation therapists. Presently, there is a tendency to limit the use of ionizing radiation to the treatment of malignant conditions and to ignore their application to certain benign conditions where radiation therapy could be used safely and successfully. Approximately 40 radiologists are practising in Canada as full-time radiation therapists. Well trained and qualified radiation physicists are increasing in number and contributing to the progress of radiation therapy. A striking example of that is the development of the Cobalt^{60} beam therapy units. The application of radioactive isotopes to the diagnosis and treatment of diseases remains limited.

The instruction and training of radiological technicians has now been modified markedly by dividing the course into diagnostic or therapeutic radiological technique. A separate syllabus for training in therapeutic radiological technique. A separate syllabus for training in therapeutic technique alone has been prepared and recently adopted by both the Canadian Association of Radiologists and the Canadian Society of Radiological Technicians. As of this year, the student technician must decide at the beginning of the period of training in which branch of radiological technique certification is desired.

The question of exposure to ionizing radiation has grown to be of considerable concern to various groups of scientists and also to the public at large. Numerous articles have appeared in the press discussing radiation hazards not only from the standpoint of atomic warfare but also of potential excessive exposure from medical applications such as X-ray examinations. There may have been some exaggeration, but radiation hazards cannot be denied and even less ignored. Radiologists have been fully aware for a long time of the dangers of excessive exposure of patients and radiological personnel to ionizing radiations. With the collaboration of radiation physicists, every possible adequate measure is taken to ensure adequate protection to our population. Methods of radiation protection are under constant revision, and in that respect Canadian radiologists are quite conscious of their responsibility to both the present and the future generations.

On April 10, 1957, the adoption by the Federal Government of Bill 320 has authorized "contributions by Canada in respect of programmes administered by the provinces, providing hospital insurance and laboratory and other services in aid of diagnosis". It was fully anticipated that any such health scheme would include radiological diagnostic services. The Canadian Association of Radiologists was not opposed in principle to such a government sponsored health plan. On the contrary, Canadian radiologists have been in favour of making available to all Canadians the best radiological services possible. We are opposed however to the listing of radiological services as hospital services as they appear in Bill 320. The interpretation of radiological procedures certainly is not a hospital service and represents nothing else but a medical act which may be rendered only by duly trained and recognized physicians. Unless this principle is safeguarded in the elaboration of provincial plans to implement Bill 320, the impact on the practice of radiology in Canada might prove to be adverse to the best interest of our population. With the application of such a health scheme, the demand for radiological diagnostic services will increase throughout Canada to a point with which it will be very difficult to cope. Anything that will be done to lower the status of the radiologist as a physician to that of a hospital or government employee would be adverse to the health plan itself. The quality of radiological services in this country has attained a high standard. Unless the conditions of practice of radiology in Canada remain attractive, it is doubtful if a sufficient number of young medical men will be interested in studying radiology as a specialty and thus become available to render the radiological services required and to maintain or even improve the existing standards of high quality.

JEAN BOUCHARD, M.D.

**Condensed presidential address at the 21st Annual Meeting of the Canadian Association of Radiologists in London, Ontario, January 12th to 15th, 1958.*

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THE GORDON RICHARDS MEMORIAL LECTURE

Gordon Richards and The Ontario Cancer Foundation*

W. G. COSBIE, M.B.
Medical Director, The Ontario Cancer Treatment and Research Foundation
Toronto, Ontario

I consider it a great honour to be invited to give the Gordon Richards Memorial Lecture before this Society. At the same time, I am grateful to you for providing me with the opportunity to pay tribute to one whose close friendship influenced my own career and gave me the opportunity to be a better physician because of long association with him in his work.

Previous lecturers have reviewed his life and his career. To their contributions I have little to add, but perhaps I may present to you some of the things I came to know of him which may leave a clearer picture of this great man with you.

Tradition is lacking in any young institution — my own specialty of obstetrics and gynaecology has a history going back on the one hand to the birth of mankind and on the other to the beginning of abdominal surgery. Radiotherapy on the other hand had its beginning within the memory of many who are here present, and so far as this country is concerned was born of the efforts of the contemporary group of which Gordon Richards, by his ability and industry, became the outstanding leader.

With his appointment as radiologist to the Toronto General Hospital in 1917, the opportunity came which launched him on his career as a radiotherapist. As time went on, his association with the late Dr. W. H. Dickson, and later Dr. A. C. Singleton allowed him to concentrate his energy increasingly in the study and treatment of cancer. Once his feet were set in the way he should go, all his great energy and unflagging industry were concentrated in developing radiotherapy as a means of treating cancer. He came into his career at the most opportune time; modern anaesthesia, anti-shock therapy and antibiotics were not yet ready to open the door to more radical surgery, and many therefore were turning to this method of treatment which offered a new hope of cure not attended by a mortality that at times was thoroughly discouraging. He, the acknowledged Canadian pioneer of deep X-ray therapy, was also one of the first to use radium in an effort to study its effectiveness in cancer therapy. In this role, he had the asset of an original mind, impatient of stasis and at times prompted by an almost spontaneous inspiration. He had the ability to stimulate an "esprit de corps" in his department, built on a feeling of intense personal loyalty to the chief, which still remains strongly impressed on the memory of those who worked for him.

He carried the same pioneer spirit into his life's work which had prompted him to start practice in a mining camp in British Columbia. He was always living in the hinterland of the science of his profession — constantly probing into the unknown. The fertility of his orginality was only matched by the incisiveness of his decision.

Time permits the briefest reference to certain things which he did, to show the kind of man he was.

I am indebted to Mr. T. B. Hurst for the details of the first two of these, namely: the designing of the 400 Kv High Voltage Unit which Picker X-Ray Engineering Limited built on his specifications, and which is still in use at the Toronto General Hospital. The feature of this unit is that by using two tubes, four patients can be treated at one time, and by the use of individual safety locks controlling lead shutters, the exposure from any of the four ports of entry can be shut off independently. This equipment was the first of its kind developed in the world.

He also devised a modification of the Seivert Tele-Radium bomb (Fig. 1) with a head particularly designed for treatment of the neck and breast areas, and with a rotational mechanism which controlled not only the degree of excursion from full rotation to any desired arc of a circle, but also time variation. These features were entirely original.

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*Presented at Annual Meeting, The Canadian Association of Radiologists, January 13-17, 1957, Montreal.

One Monday morning, Richards came down to the gynaecological clinic greatly interested by an article in *FORTUNE* magazine which he had read the previous day. It dealt with the new nylon industry, and he was impressed by the similarity in chemistry of nylon and body tissue. Thus he was prompted to design nylon applicators for use in treating cervical cancer. These could be moulded into convenient shapes and were free from the faults associated with metallic applicators in rubber sheaths, because of the molecular composition of nylon and its freedom from impurities. One is impressed with the acuteness of a mind that saw this possibility in the midst of a Sunday's leisure reading!

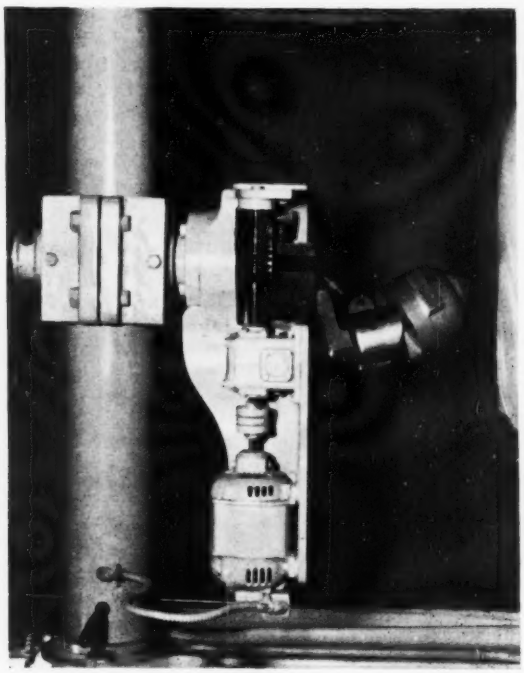

Figure 1. Rotational Radium Bomb 1935.

In 1939, Temple Fay of Philadelphia reported his study of the effect of refrigeration and hibernation on cancer and the control of pain. Richards was impressed with the possibilities of this new physical agent, and after a visit to Fay, had a refrigerating unit assembled (Fig. 2). Six gynaecological patients were treated in April and May 1940 with three fatalities but with pain relief in the others. When he felt that the method had been tried in the balance and found wanting, he discarded it, recorded his findings, and dismissed it from his mind.

In the pressure of this busy routine, which left little time for the softening influence of leisure, he did not fail in the appreciation of the value of personal interest in the problems of the individual patient. How much courage this brought into the hearts of those he treated! This was strikingly demonstrated at a dinner which he organized for the five-year-and-up survivors, and was attended by about 100 old patients, and from which a message of hope was broadcast.

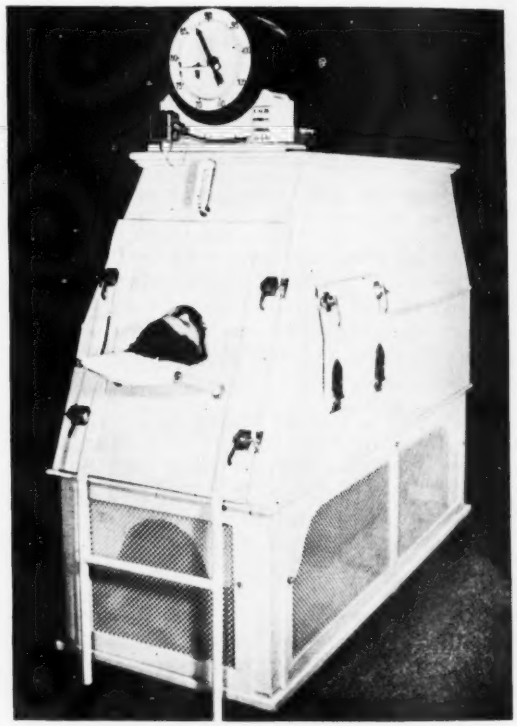

Figure 2. Regrigerating Unit 1940.

Lastly, I want to pay tribute to him for his most outstanding achievement in the development of the combined clinics, which were held every day at the Institute. Here, the various surgical consultants and Richards saw the patients, studied their lesions, planned their treatment and assessed the results. One has only to refer to the work with Wookey on oral and tongue lesions, and with Janes in cancer of the breast, to indicate the outstanding value of the planned approach to therapy which resulted. Here again in leadership, he developed his type of multiple applicators for use in uterine cancer (Fig. 3), and the clinic showed the value of a combined method of treating this disease. So far as one has knowledge this feature of associated responsibility was unique for many years.

As those dark days of 1948 foreshadowed the inevitable valley, he maintained his interests to the end. The days in hospital increased, and the intervals when work was possible lessened. In the heritage he left behind him to his successors is the memory not only of inspired accomplishment, but also of patient and enduring courage.

Figure 3. Richards' Multiple Intra-Uterine Applicators 1937.

Gordon Richards' name will always be associated with two organizations developed in the effort to control cancer. He was not actually associated with the Canadian Cancer Society but he was an inspiration to it, and constantly supported it with his advice. This was particularly true when he organized a campaign in 1945 to raise money to develop the programme of the Ontario Cancer Foundation, especially with regard to the extension of the radiotherapy clinics. By this effort, he showed the members of the Society how generously responsive the public would be to a well-presented demand for financial support. This campaign was the first of its kind in Ontario, and the results provided a large capital fund for the newly-formed Ontario Cancer Foundation, which even to this day is the means of financing its clinic construction programmes.

On the other hand, from its inception, he was the great driving force in organizing the work of the Ontario Cancer Foundation. He was the first managing director and the chief advisor to the board of the Foundation in its formative years.

The beginning of government support in the control of cancer in Ontario came as a result of a Royal Commission, set up in 1931 to enquire into the use of radium and x-ray in the treatment of the sick. This commission, under the chairmanship of the Honourable Dr. H. J. Cody and consisting of Professor Sir John McLennan, Professor W. T. Connell and Mr. Arthur Ford, visited the leading centres in the U. S. A., England, France, Belgium, Germany and Sweden, and after due consideration recommended that the treatment of cancer with radium should be centralized in clinics established in connection with the major teaching hospitals of the three medical schools in Kingston, Toronto and London. Beginning in 1932, the Department of Health entered into agreement with the Toronto General, Kingston General and the Victoria Hospital, London, to provide radium and annual maintenance grants, and an act was passed establishing these three centres as Ontario Institutes of Radiotherapy. Soon after this, four other centres where considerable radiotherapy was being given were recognized as clinics to be affiliated with the Department of Health. These in order of establishment were at the Metropolitan Hospital, Windsor, the Ottawa General, Hamilton General and Ottawa Civic Hospitals. From the first the directors of the clinics were encouraged to maintain uniform records, the statistician to the Department of Health giving them very valuable guidance and the department supplying the record forms. Thus, with consideration for proximity to a medical school, the population to be served and the hospital facilities available, the first seven clinics were established across the province.

Gradually, with very modest support, the work in the seven clinics developed and grew in volume as the profession learned to recognize the value of the work that was being done. In 1943, the Provincial Government recognized that further support was required and further organization was necessary. As a result, The Ontario Cancer Treatment and Research Foundation was incorporated by a special Act of the Legislature, and was empowered to conduct a programme of diagnosis, treatment and research in cancer. This included the establishment of a hospital centre, the laboratory and clinical investigation of cancer problems, the development of diagnostic centres, the maintenance of records,

lay and professional cancer education, the transportation of patients and the establishment of research fellowships.

The next year, in April 1944, the Provincial Government paid its first grant of $500,000 to the Foundation, and it began to function. The members of the Foundation were appointed by the Lieutenant-Governor in Council and under the chairmanship of Mr. Arthur Ford, editor of the London Free Press and Chancellor of the University of Western Ontario, represented the farm, labour, industry, science, women's organizations, and organized medicine. An advisory medical board, similarly appointed, was established under the chairmanship of Dr. Richards and with Dr. Norman McCormick of Windsor as secretary. In addition to the clinic directors, this board included representative scientists, pathologists, physicians, and surgeons. At an early meeting of this board it was decided to follow the system of the British Empire Cancer Campaign and set up committees for dealing with various aspects of the Foundation's programme, such as Scientific and Clinical Research, Cancer Centres, Education, Editorial and General Management. Leading authorities were invited to make up these committees.

In these early days, the Minister of Health, Dr. Percy Vivian, was very co-operative and helpful in planning the future of the Foundation, and this support and guidance has been continued by successive ministers and their deputies. A survey of the cancer problem was made, and the members of the Foundation and the Advisory Board became convinced that their plans would soon surpass the limits possible with the funds available. In April 1946, the Foundation in collaboration with the Cancer Society launched the campaign for funds which has been referred to previously. Although this did not reach the objective of $2,000,000 which was planned, nevertheless the Foundation acquired by this means, and the unexpended portion of the original grant, approximately $1,500,000. Thus it was in a position to embark on its planned campaign.

After considerable thought, the Foundation approached Queen's University and the Kingston General Hospital, where a new wing wes being completed, with an offer to set up an all-inclusive cancer clinic. The Foundation undertook to rent the necessary area in the new wing to provide quarters for the clinic and to equip it for radiotherapy. Surgeons and physicians were appointed to the clinic on the recommendation of Queen's University, and it was planned that advantage would be taken to use the operating rooms available in the hospital. This clinic was officially opened on March 20, 1947, and Dr. R. C. Burr was appointed Director. It was hoped that it represented a type which would be developed in other centres as well, but for many reasons, the further development of the other clinics has been confined to radiotherapy alone.

Since the opening of the Kingston clinic, the Foundation has been able to give substantial grants to the hospitals in which its clinics are located, which have enabled them to construct suitable quarters for cancer clinics housing modern therapeutic equipment. It has then equipped and maintained the clinics paying a rental to the hospitals for services provided. These clinics have been developed as integral units of the Foundation, controlled and supported financially by it. On this basis, the Hamilton Clinic was taken over in 1951, the Ottawa Civic in 1952, and London and Windsor Clinics in 1954. Distinct features of all the clinics of the Foundation are the honourary associate consulting staffs, representing all the surgical and medical specialties. The staffs provide a means for the director to explore all the possibilities of treatment, and to conduct follow-up observations of the patients with the aid of specialists whose services may be necessary in the face of some complications. The members of the staffs are nominated by the faculties of Medicine when the clinic is associated with a medical school, and in the other clinics by the local medical societies.

With the growth in the work of the clinics, an increasing number of full time radiotherapists have been employed by the Foundation. At present, in addition to the clinic directors, there are ten, and also seven radiotherapists in training.

Up to 1951, the major equipment of the clinics was high voltage at 400 Kv. In that year, Atomic Energy of Canada produced its first Model A Cobalt^{60} beam therapy unit, and it was installed in the Foundation's London clinic. Although the clinic at Saskatoon had installed a custom-made unit several weeks previously, the first treatment in the world was given by Dr. Ivan Smith on October 27, 1951, to a patient suffering from recurrent malignant melanoma. At the present time, there are six other Cobalt^{60} units in the Foundation's clinics, the Theratron in use at the Windsor clinic being the first rotational model in use in Canada.

The first radiation physicist employed in the Foundation system was the late J. G. Brown, who came to the Toronto Institute under Dr. Richards in September 1946. His

contributions were many, and his untimely death two years ago has left a memory of faithful service with all who worked in London in the early days with the Cobalt unit. The number of physicists has grown remarkably, and now there are 14 of them, including several whose special training is extending their work into the further field of biophysics. In order to provide proper facilities for their work, all the clinics are now provided with adequate laboratories and work shops staffed by the necessary personnel.

From the beginning, Dr. Richards always had plans for a major centre to be developed in Toronto. Although it was denied him, his conception did not die in the minds of those who where responsible for bringing about the establishment of the new Cancer Institute now nearing completion in Toronto (Fig. 4). While it must be realized that excellence in therapy has been attained in the smaller centres, the fact remains that about 40% of the patients are treated in the Toronto centre (Table I) and because of its association with the University of Toronto, the opportunity for research is particularly good. Therefore, the building of an outstanding Institute in this city, under these circumstances, has seemed a natural development.

Certain fundamentals have governed the plans for the Institute. The first of these is that it should be the centre for radiotherapy for the four university teaching hospitals. On this basis, it has been located on land adjoining the Wellesley Division of the Toronto General Hospital; plans have been made to have equal representation on the consulting staffs from all the university hospitals, and arrangements for the basis on which patients will be referred there for treatment. Secondly, it is to be closely associated with the University of Toronto and recognized as a University hospital and research centre, so that

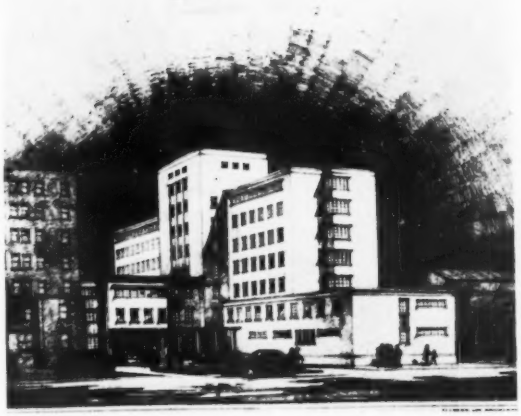

Figure 4. The new Ontario Cancer Institute, Toronto.

not only will the facilities for research which it will provide be available to interested departments of the University, but also the staff of the Institute may be integrated into the University. This broad basis has stimulated an ever-extending plan until now, in addition to radiotherapy, reseach departments in physics and biology have been developed. Provision has been made, not only for equipment such as a 24 Mev. Betatron and 3 Mev. Van de Graaff generator, but a full range of laboratories to allow the complete study of patients with cancer and under treatment. The hospital has accommodation for 87 patients including children, and there is also a large and well-equipped out-patient department. Two floors of the seven story building are designed for the department of biological research. Time does not permit a longer consideration of this Institute. Suffice it to say that under Drs. Clifford Ash, Harold Johns, Arthur Ham and Harold Warwick, the possibilities which it presents allow the greatest optimism.

TABLE I
New Cancer Cases Treated By Radiotherapy
1946 - 1955

CLINIC	*YEAR*									
	1946	1947	1948	1949	1950	1951	1952	1953	1954	1955
Hamilton	462	505	421	434	473	572	513	561	558	620
Kingston	211	221	280	260	257	281	280	322	367	339
London	427	426	515	534	496	533	829	833	731	753
Ottawa Civic	364	338	384	330	346	343	427	293	258	248
Ottawa Gen.	85	89	97	69	73	97	103	102	80	80
Thunder Bay	—	—	39	62	67	62	79	66	97	83
Toronto Cl.	1,199	1,082	1,065	1,133	1,205	1,238	1,410	1,395	1,503	1,547
Windsor	265	257	253	273	268	290	272	260	315	327
TOTAL	3,013	2,918	3,054	3,095	3,185	3,416	3,913	3,832	3,909	3,997

It was the establishment in 1948 of the Dominion and Provincial matching grant system that has allowed the Foundation to embark on its extended programme. It should be realized at the same time that the money so provided may not be used for building purposes. Therefore, in the building of the new Institute the Provincial Government has made a special grant of $5,000,000. Otherwise, clinic construction has been supported by the original capital fund already referred to, and an annual grant of $50,000 which the Ontario Division of the Canadian Cancer Society makes to the Foundation.

The Foundation is indebted also to the Hamilton unit of the Cancer Society for providing the special addition to the Hamilton Clinic which houses the Cobalt therapy unit and to the Lions Club of Ottawa for a similar addition to the Clinic at the Ottawa Civic Hospital.

In 1945 Dr. Richards and some members of the Advisory Medical Board visited Northern Ontario and the Lakehead, and as a result Diagnostic Clinics were organized in Sudbury, Timmins and Port Arthur-Fort William. The objective was to provide centres where patients could be brought by their physicians and consultations could be held with a group of specialists nominated by the local Medical Societies. Thus, long journeys could be obviated, and later on follow-up examinations could be made, the Foundation providing transportation for needy patients from the Clinics to the nearest therapy centre. At a later date, a fourth clinic was organized at Kirkland Lake. At one time it was thought that this type of clinic might become popular in Southern Ontario, but this has not been the case. On the other hand, the clinic at the Lakehead has provided the basis on which a radiotherapy centre has been established in the Port Arthur General Hospital under Dr. W. A. Hargan. Although the population which is served is small, the geographical situation justifies this service in a community which is highly appreciative. A fine example of this spirit was evident in the generous gift to the clinic by Senator Norman Paterson of Fort William of a Cobalt unit which was put into service in June 1954.

Two other developments in treatment centres are worthy of note. The first is the auxiliary treatment centre in Sarnia, where certain treatments are given by Dr. F. T. Miles under the control of Dr. Ivan Smith and with the collaboration of the staff of the London clinic. This type of association may well be considered as the answer to the necessity of providing other clinics at strategic situations. The second is the development of consultative and follow-up clinics in Pembroke and Cornwall by Drs. Stoddart and Caton of Ottawa, and Dr. Burr of Kingston. This co-operation is greatly appreciated by the local profession, and is the basis of a proper approach to planned methods of therapy which has much to offer.

When the National Cancer Institute was established in 1947, the Foundation turned over to it the projects in fundamental research which it was supporting and now confines its interest to clinical research. This is a reasonable arrangement, and is justified by the close association of many of the latter problems to the highly organized centres of the Foundation. Besides the $83,000 the Foundation obtains from the matching grants and turns over to the Institute, it disburses approximately $75,000 annually in grants for clinical research, and supports six Research Fellows in the University Hospitals.

Besides the diagnostic clinics of northern Ontario, the Foundation's interest in the early diagnosis of cancer has been responsible for two other services. Since 1948 it has supported a Cancer Detection Clinic at the Women's College Hospital, Toronto. In the eight years that this clinic has functioned 12,010 women have been examined and 127 malignant lesions have been diagnosed. As an encouragement to the diagnosis of cancer in the doctor's office, a free biopsy service was established in 1951. This has developed steadily, and whereas 813 physicians sent in 6,290 biopsies the first year, 2,879 doctors and dentists submitted 18,018 in 1955, and 3,179 malignant lesions were diagnosed by this means.

From the beginning, the Foundation has received the greatest help in the maintenance of records from the Department of Medical Statistics of the Provincial Department of Health. Since 1951, Dr. A. H. Sellers, Statistician to that Department, has also been Medical Statistician to the Foundation. On his advice, in July 1950 a tumour registry was organized at the Toronto General Hospital. Previous to this, the Kingston clinic was the only centre maintaining records of surgically and medically treated patients. The great volume of work at Toronto prompted this extension of the excellent system which Dr. Richards had maintained in his clinic, and now the complete registry has records of 28,366 patients including 4,793 cases of cancer of the breast. 2960 of the cervix and 2000 of oral cancer. There is an annual increment of about 2500 cases, a good follow-up is maintained, and up to the end of 1955 statistics for 18 major clinical surveys have been provided.

The Foundation is offering support of similar registries in the other hospitals, where radiotherapy clinics are maintained, and some are already organized. During the last two years, the offer was also extended to the three university teaching hospitals in Toronto, in addition to the General Hospital, and also to two other major hospitals in the city. It is interesting to note that the registry at the Hospital for Sick Children will commence to function on the basis of the records of 1,218 patients upon whom a follow-up study has been maintained in a survey of cancer in children by Dr. W. L. Donohue, which was previously supported by a research grant.

Under the supervision of Dr. Sellers and his associate Dr. E. N. McKay, the Foundation has co-operated with the Ontario Medical Association, the London Academy of Medicine and the Department of Health in a survey of cancer conducted in Middlesex County in 1953. With the co-operation of the local profession, considerable valuable material was collected, and the report has received a very wide acceptance.

In recent years there has been increasing co-operation with the Ontario division of the Canadian Cancer Society, and at the present time two members of the Foundation are representatives of the Society. Two joint committees are working on problems of interest to both organizations. The first is the development of a system of hostels to accommodate ambulatory patients under treatment in our centres, and the second is a survey of the welfare needs of patients confined to their homes. The first hostel provided by the Society and maintained by the Foundation was opened early last summer, in association with Dr. Lloyd Green's clinic at the Hamilton General Hospital; the welfare survey is being conducted in Waterloo County and also in the city of Toronto. These two projects are of timely interest, contributing not only to the comfort and morale of patients, but also providing data which may be of value in the consideration of hospitalization schemes.

One of the most valuable features of the province-wide treatment centres is seen in their association in clinical conferences. These have become well organized in recent years, and now all the radiotherapists, radiophysicists, and consultants particularly interested in the subject under consideration, the pathologists and the medical statistician take part. The large volume of cases available provides a broad basis for a comparison of ideas. For example, 967 cases of cancer of the corpus uteri, 607 of the urinary bladder, 224 of the intrinsic larynx, and 673 of the tongue have been available for review; at a recent meeting, 18 papers were presented on the experience of the clinics in the use of $Cobalt^{60}$ therapy. The interchange of ideas from groups working independently yet co-operating in the same system has been very satisfying.

When one looks back on the 13 years of the existence of the Foundation, it is well to realize that the present has been built on the firm foundation of the past, which was provided not only by Gordon Richards, but also by Robert Patterson, William Jones, Bert Walkey and George McNeil. The membership of the Foundation, its advisory medical board, and committees naturally have changed during the years, but it can be said that all who have taken part have given generously of their wisdom and their time to the problems which have been faced and the organization which has been developed.

These years have seen great progress in the study of the nature of cancer and its treatment. Surgery has developed access to previously unapproachable lesions, and seems for the time being at least to be limited only by the necessity to preserve the essential organs of life. Radiotherapy has been developed to a high degree of precision with the benefit not only of radiation physics but also, as both physics and chemistry in the study of radiotherapy and cancer move further on their converging lines, of biophysics, biochemistry and biology. The day is past when radiotherapy can remain merely in association with diagnostic radiology. This has little to offer in the future. It is to the cancer therapist, aware of all the possibilities of chemical and biological research, whose training and practice makes him constantly alert to apply every advance to the improvement of his own peculiar skill, that the future belongs. Not only is it certain that this is the road to a better application of radiation therapy, but who knows that it may not lead to the solution of the very genesis of malignant disease?

BOOKS RECEIVED

Books received are acknowledged in this department, and such acknowledgment must be regarded as a sufficient return for the courtesy of the sender. Selections will be made for review in the interests of our readers and as space permits.

Radiological Physics by M. E. J. Young, H. K. Lewis & Co. Ltd., London, England, £2. 2s., 1957.

CEREBRAL ANGIOGRAPHY IN HEAD INJURIES*

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MAURICE DUFRESNE, M.D.
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It is the purpose of this paper to report on our personal experience in the use of cerebral angiography in the localization of intra cranial hematomas.

Cerebral angiography was found to be extremely useful in the handling of accident cases and in our opinion less dangerous than other means of neuro-surgical investigation when performed for specific indications and under appropriate circumstances.

Indications

The simplest way to delineate the proper use of angiography in head injuries is to outline first the conditions in which it should not be performed. It should not be done upon admission on a patient who has remained conscious, who has recovered consciousness or who, although unconscious. reacts to pain equally well on both sides unless there are localizing signs on one side (paresis, a Babinski response or a dilated pupil), even if there should be a linear fracture of the skull. All such cases should be kept under close observation.

If the patient becomes less conscious or if localizing signs appear in the following hours or days, angiography must be performed.

It may be done on one side alone if the localizing signs are sufficiently precise; even then the antero-posterior films should be made first. In other instances particularly when there are conflicting signs, the injection is usually performed on both sides.

At present, it is used even when localizing signs and plain X-Rays are strongly indicative of the side of the lesion. Thus, useless operations, based on false localizing signs are avoided as are errors in localization particularly errors concerning the side of the lesion in cases presenting ipsilateral pyramidal tract signs.

Rarely, one discovers an unsuspected pathological cause for the accident or the haemorrhage such as an angioma, an aneurysm or even a brain tumor.

Only the typical epi-dural hematoma, especially if decerebration appears to be imminent or is already established, will be operated on immediately under local anesthesia combined with intravenous chlorpromazine in order to avoid delay in relieving brain-stem compression. When a slight delay is possible as is often the case since the use of chlorpromazine, arteriography will be performed and quite often will reveal an intra-cerebral lesion which might have been found with difficulty during an undirected craniotomy.

A patient in whom signs of brain stem injury (deep coma, a pounding pulse, stertorous breathing, dilated pupils) appear immediately following accident will be submitted to arteriography unless his general condition does not allow it.

In this manner, space occupying lesions of any consequence can be ruled out more quickly, more surely and with less added trauma to the patient than with the method of multiple burr-holes. In such cases, chlorpromazine is indispensable to avoid or even resolve decerabration.

Results

Between January 1st, 1949 and November 1st, 1956, 1370 angiograms were performed and of these 215 were cases of head injury. 170 of these patients were men and 45 were women.

The number of angiograms performed in cases of head injury has increased from year to year, from 4 in 1949 to 56 in 1955 while the number of patients treated has certainly not increased in a similar fashion. This must be attributed to a more frequent use of the method as its indications have become more precise although the increasing severity of the cases treated may also be a factor.

It is striking to see what a large proportion of accident cases occur in patients 21 to 30 years old (Table 1) and to correlate these figures with the fact that road accidents represent 62% of all accidents, 51% of the entire group being car accidents (Table 2). 51 cases fall in this group age with a second peak between 41 and 50 years, possibly because of a greater number of industrial accidents within this latter group.

Presented at Annual Meeting, The Canadian Association of Radiologists, January 13-17, 1957, Montreal.

TABLE I

AGE DISTRIBUTION

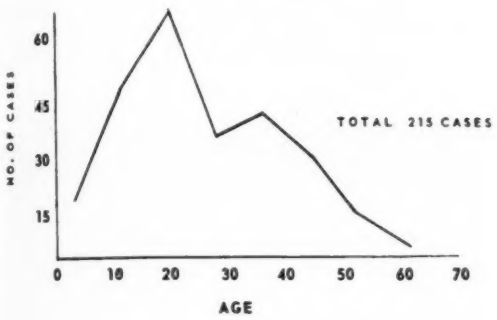

TABLE II

TYPE OF ACCIDENTS

ROAD ACCIDENTS		62%
AUTOMOBILE	51%	
MOTORCYCLE	7%	
TRUCK	2%	
BUS		
TRAMWAY	1%	
TRAIN		
FALL ON HEAD		21%
SIDEWALK		
STAIRWAY etc....		
SHOCK ON HEAD		17%
FIGHT		
SPORT - Hockey		
Baseball		

TABLE III

RESULTS

101 NEGATIVE EXAMINATIONS

108 POSITIVE EXAMINATIONS

- 53 SUBDURAL HEMATOMAS
- 33 EPIDURAL HEMATOMAS
- 27 INTRACEREBRAL HEMATOMAS
- 7 SUBDURAL HYGROMAS
- 2 ARTERIOVENOUS ANEURYSM
- 1 INTERNAL CAROTID THROMBOSIS
- 1 TRAUMATIC ARTERIOVENOUS ANEURYSM
- 1 MENINGIOMA
- 1 ARTERIAL ANEURYSM

4 FAILURES

Out of 215 angiograms, 101 were found to be negative. This examination may have saved these 101 patients from a surgical exploration which seemed warranted but which would not have left the surgeon with the same feeling of security as could have been obtained from the absence of vascular displacement.

In six cases angiography failed or at least was not pursued most of these were in young children and were performed in the first years that the method was used.

There were 114 space-occupying lesions in the group of 215 cases (Table 3.) Obviously, there were more lesions than there were patients since some of the patients had multiple lesions.

We have the same impression as Wickbom[10], Engeset[4] and Christiansen[2] that some of the 27 intra-cerebral hematomas would have been missed by multiple burr-holes. In this respect, it is important to record that half of the acute subdural hematomas were temporal in location. One-third were parietal in location with some frontal and perhaps occipital extension. Ten per cent were predominantly frontal and 7% were predominantly occipital in location. In chronic subdural hematomata the percentage of parietal examples is higher. It is only a rare posterior fossa subdural hematoma or hygroma that might be missed by carotid angiography.

Only 3% of the lesions were bilateral in contrast to statistics established before the use of angiography. When operation is necessary, the method makes for a simpler procedure by establishing pre-operatively whether the lesion is unilateral or bilateral thus avoiding the need for a complicated bilateral exploration, a method still in use where angiography is not performed in traumatic cases.

Obviously a fracture unless depressed is of no importance clinically except as a possible sign of cerebral damage or as a tentative indication of the site of the lesion. In 1950 Engeset[3] wrote: "Skull examination may be entirely negative in many cases of verified intracranial hematoma". In 77 patients of our 215, plain X-rays revealed skull fractures. 37 of these had a negative arteriorgraphy while 53 positive angiograms were found in patients who had no detectable skull fracture on plain films.

Munro and Malthy[7] wrote in 1941 "It is our opinion that extra-dural hematoma probably do not occur in the absence of fracture", presuming that the stripping of the dura resulted not from haemorrhage but from the trauma. However, there were 8 cases of epidural hematomata out of the 25 in this series

in which no fracture was found on plain X-rays. Admittedly, some fractures may have been missed by us but certainly not in this proportion.

Radiological Findings

The appearance of a chronic sub-dural hematoma after pneumography is well known by radiologists. Olsson[9] as early as 1948, described very well how such images are formed. A chronic subdural hematoma which is limited by its membrane is partially absorbed after a certain time thus allowing for the appearance of a virtual space between the membrane and the compressed brain. Under these circumstances, air injected through the lumbar sub-arachnoid space can infiltrate this cavity and delineate with precision the hematoma which appears as a homogenous mass of the same density as other soft tissues (Fig. 1.)

Figure 1. Chronic sub-dural hematoma shown by pneumo-encephalography.

On the other hand, it is impossible to outline an acute sub-dural hematoma in this way and moreover a lumbar puncture would be dangerous in the presence of increased intracranial pressure. Air will not penetrate about an acute sub-dural hematoma exerting pressure on the brain. However, cerebral angiography provides a characteristic picture of an acute or a chronic sub-dural hematoma during the arterial as well as during the venous phase (Fig. 2 and 3.)

A chronic sub-dural hematoma will present as a biconvex lens-shaped mass between the inner table of the skull and the peripheral arteries or the ascending cerebral veins as the case may be, because these vessels cover the surface of the brain which is pushed away by the hematoma.

Figure 2. Chronic sub-dural hematoma (arterial phase) biconvex lens — shaped mass between parietal bone and sylvian arteries. Shift of anterior cerebral artery.

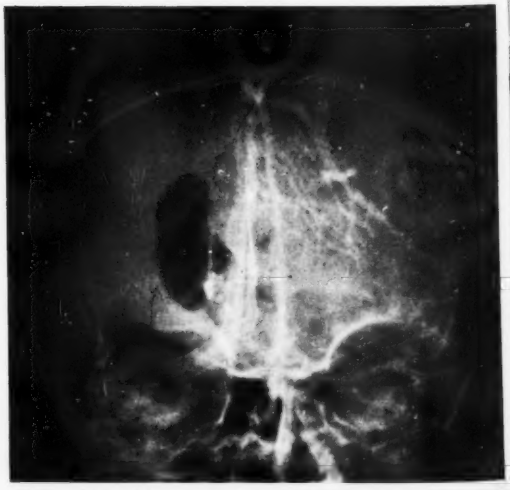

Figure 3. Chronic sub-dural hematoma (venous phase). Ventricular displacement is also shown by encephalography.

A sub-dural hematoma becomes chronic when it has a definite membrane, about the third week. At that stage, the membrane favors further expansion of the hematoma because its high osmotic pressure draws more fluid within it as Norman[8] has explained.

This mass deviates the midline cerebral vessels (anterior cerebral artery, peri-callosal artery or internal cerebral vein). If a hematoma exists on both sides (Fig. 4) producing an even compression of both hemispheres the proper position of the mid-line structures is maintained.

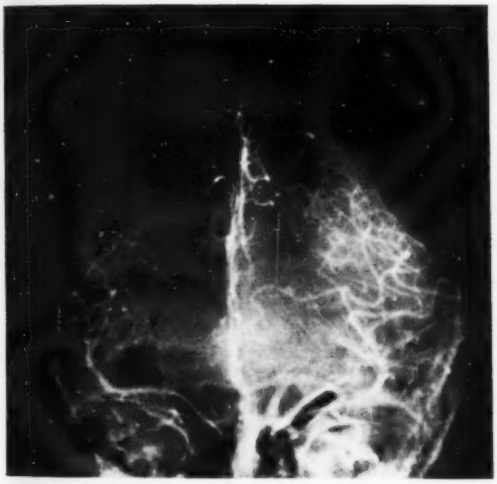

Figure 4. Bilateral chronic sub-dural hematoma. Bilateral biconvex lens — shaped mass superficial to the sylvian arteries. Anterior cerebral artery is on the mid-line.

In an acute sub-dural hematoma, superficial cerebral vessels are pushed inward but the surface of the brain is parallel to the inner table of the skull since the pressure of the blood clot is applied equally on all the various points of this surface (Fig. 5). The mid-line vessels are pushed aside unless there is a bilateral lesion (Fig. 6).

The displacement of peripheral vessels which is found in an epidural hematoma will usually be much less obvious since the dura affords a strong resistance to stripping, being adherent to the inner table of the skull (Fig. 7). However, only one picture is characteristic of an epidural hematoma. It is the displacement of the superior longitudinal sinus which was first described by Wickbom[10] in 1949 (Fig. 8). We have seen images suggesting a displacement downwards of the superior longitudinal sinus when this was actually a displacement of the ascending cerebral veins as they course along the longitudinal sinus. This was the result of a sub-dural hygroma or hematoma (Fig. 9).

While a parietal lesion will readily displace the anterior cerebral artery, a temporal lesion will do so only rarely (Fig. 10). Such temporal lesions account for 50% of all the lesions which were demonstrated and they are

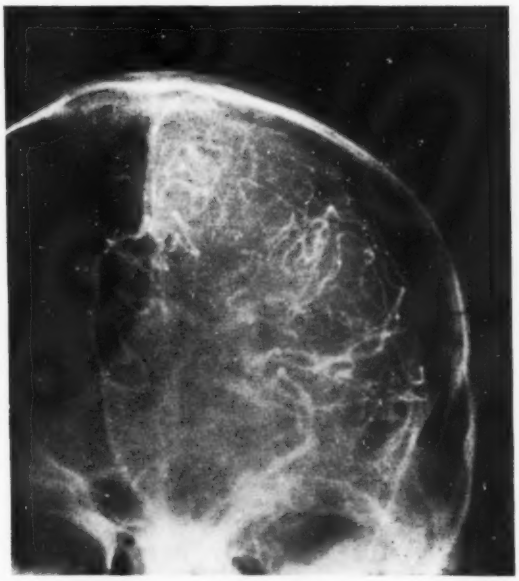

Figure 5. Acute sub-dural hematoma. The brain surface runs parallel to the internal table. The fracture line is visible. The anterior cerebral artery is shifted.

Figure 6. Bilateral acute sub-dural hematoma in a child. The anterior cerebral is not shifted.

characterized by an upward displacement of the Sylvian group of arteries. On an A.P. film, this group will be seen to course upwards and outwards in a diagonal fashion from the carotid bifurcation and as mentioned above, there rarely exists a deviation of the anterior cerebral artery especially in extra-cerebral lesions.

The anterior cerebral artery may be slightly curved by an intra-cerebral temporal lesion. One must learn to distrust a mid-line pineal gland or septum pellucidum in such instances.

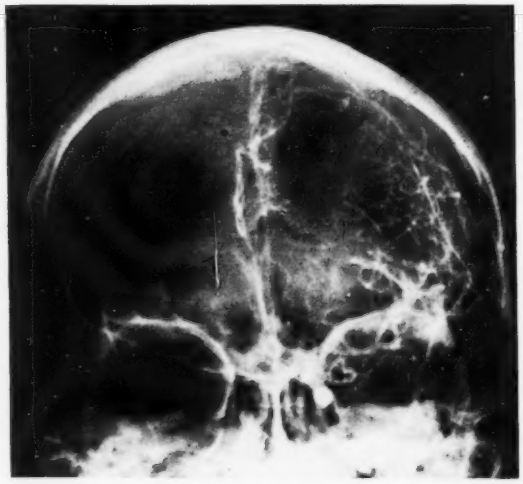

Figure 7. Epi-dural hematoma. The displacement is more circumscribed as well as the shift of the anterior cerebral artery.

Figure 8. Epi-dural hematoma. Fracture and displacement of superior longitudinal sinus. This patient died before any operation.

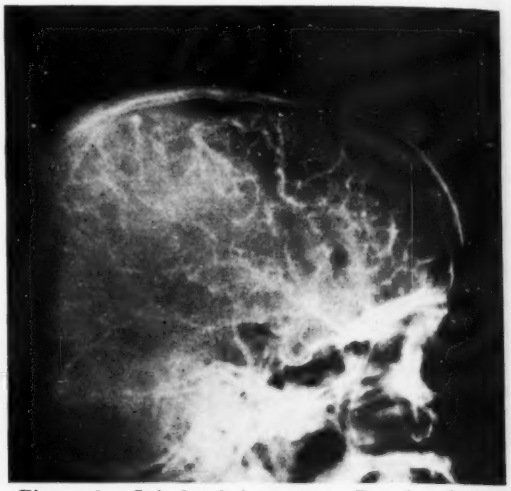

Figure 9. Sub-dural hygromas. Pseudo displacement of superior longitudinal sinus.

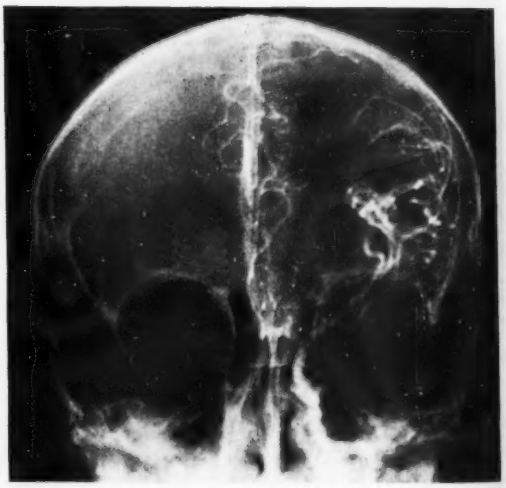

Figure 10. Temporal region hematoma. There is no shift of the anterior cerebral artery but the sylvian group is pushed upward and toward the mid line.

The upward displacement of the Sylvian group can be easily seen on lateral films (Fig. 11). It must not be forgotten that these arteries are normally highly situated in children and in chronic posterior fossa lesions with dilatation of the temporal horn, although this latter diagnosis is easily detected by angiography.

So far, it has been impossible for us to differentiate between an epidural, a sub-dural and an intra-temporal hematoma or even a contusion of the brain with oedema in the temporal region.

Figure 11. Intra temporal hematoma. Fracture line is on the other side. The sylvian group is visibly elevated.

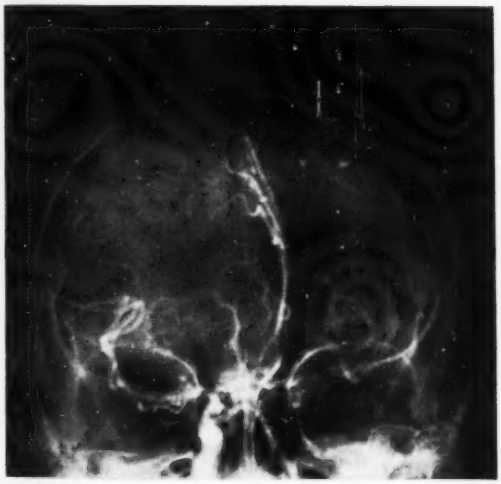

Figure 12. Epi-dural hematoma in frontal region. Shift of the anterior cerebral artery and downward displacement of sylvian group.

A hematoma within the frontal region is entirely different in appearance (Fig. 12). In such cases, the anterior cerebral artery is pushed to the other side together and there is downward displacement of the Sylvian group vessels. On a lateral film (Fig. 13), one may easily detect an avascular region giving obvious and precise localization of the lesion. Again in these cases, one cannot be sure whether the hematoma is present outside the dura, in the sub-dural space or within the brain.

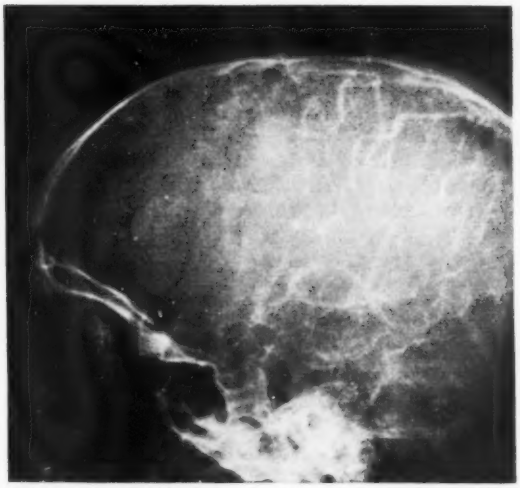

Figure 13. Epi-dural hematoma in frontal region. Fracture lines are visible in a completely avascular region.

Summary

215 cases of head injury were investigated with carotid angiography since 1949. 101 of these did not come to craniotomy since they presented negative angiograms.

Precise diagnosis and localization were possible in 108 cases, thus allowing the neurosurgeon to choose the most direct approach to these lesions. It is our belief that the percentage of recovery is enhanced by such precise diagnosis.

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10. Wickbom, I., Angiography by Post Traumatic Intra-cranial Haemorrhages, Acta Radiologica, 1949, 32, 249.

POSITION AVAILABLE

NOTE: In order to assist candidates in their application for any of the listed positions in this and future issues of the Journal, it is suggested that they communicate first with the Honorary Secretary-Treasurer of the Canadian Association of Radiologists.

Radiologist to service the Carleton Memorial Hospital, Woodstock, N.B., the Madigan Memorial Hospital, Houlton, Maine, and the Aroostook County Hospital, Houlton, Maine. Guaranteed minimum salary: $17,000. Applicant must have license to practice in New Brunswick and the State of Maine; have or be eligible to write either Canadian Certification or American Board in diagnostic radiology; must live either in Woodstock, N.R., or Houlton, Maine. Apply in triplicate to the Superintendent, Carleton Memorial Hospital, Woodstock, N.B.

MEETINGS

The Canadian Association of Radiologists — June 1958

The Special General Meeting of the Canadian Association of Radiologists will take place in Halifax, June 18th and 19th, 1958. Arrangements have been made for the meetings to be held in the Marine Room of The Nova Scotian Hotel, as follows:

Meeting of Council	9:30 A.M.	June 18th, 1958
Meeting of Council	2:00 P.M.	June 18th, 1958
Special General Meeting (Dinner Meeting)	7:30 P.M.	June 19th, 1958

Second Australasian Conference in Radiation Biology

The above Conference will be held at the Cancer Institute, Melbourne, Australia, during the week 15th to 19th December, 1958. Proferred papers on relevant subjects are invited, and titles and a 250 word abstract should be in the hands of the Convener by 31st July, 1958. Further information for those wishing to attend or present papers may be obtained from the Convener, Dr. J. H. Martin, Physics Department, Cancer Institute Board, 483 Lt. Lonsdale Street, Melbourne, Victoria, Australia.

RADIOLOGISTS AVAILABLE

Diagnostic Radiologist, certified, available for position — preferably in southern Ontario. Write to Box 3, The Canadian Association of Radiologists.

Young, married, French Canadian radiologist, bilingual, seeks employment, preferably in the Province of Quebec, at the completion of training, 1st of July 1958, pending fall examinations for certification and later if suitable. References and pertinent data on request. Box 4, The Canadian Association of Radiologists.

Locum post wanted in diagnostic radiology for one month in summer 1958 — preferably August — in any province. Box 5, The Canadian Association of Radiologists.

Assistantship wanted with Certified Diagnostic Radiologist by Canadian radiologist now resident at Henry Ford Hospital in Detroit; training will be completed by July 1958. Write to: Dr. David L. Wayne, 4283 Cortland, Detroit, Michigan.

BOOK REVIEW

Courbes et tables de radiothérapie (Graphs and tables for radiotherapy; Kurven und Tabellen für die Strahlentherapie; Curvas y tablas para radioterapie), by F. Wachsmann and A. Dimotsis, Publisher, S. Hirzel Verlag, Stuttgart, 1957.

Ce volume (17 x 25 cm, 180 pages) vient combler deux lacunes. Nous gardons tous à notre portée certains manuels que nous pouvons consulter à l'occasion, au milieu des problèmes quotidiens de la pratique radiologique. Avec l'avènement des supervoltages, de la cyclothérapie, des appareils à convergence, des radioisotopes, de la bêtathérapie à faible et à haute énergie, avec une avalanche de techniques qui voient à peine le jour pour tomber aussitôt dans l'oubli, ces problèmes se compliquent et se multiplient et nous avons constamment des données dosimétriques à éclaicir, à préciser ou à comparer. L'idée de réunir en un volume les courbes qui ont trait à l'utilisation thérapeutique des radiations ionisantes n'a rien en soi d'extraordinaire. Le mérite et l'originalité d'un pareil ouvrage résident surtout dans la sûreté du choix ou dans l'esprit critique qui doit présider à la compilation du matériel. Le nom du Docteur Wachsmann est, sous ce rapport, une parfaite garantie. Les auteurs prennent bien soin de souligner qu'il ne faut pas perdre de vue les dangers inhérents à la lecture des courbes et "qu'une mesure doit rester à la base de tout dosage". Ils ont vu à ce que les portions de graphique obtenues par extrapolation soient tracées en pointillé.

Sans surcharger cet ouvrage, qui reste d'un format commode, on a réussi à y faire figurer toutes les données physiques courantes en rapport avec la radiothérapie la plus progressive. Les légendes en quatre langues constituent une innovation très heureuse. Rares sont les radiologistes, mêlés à la recherche ou à l'enseignement, qui ne s'adonnent pas un peu à une ou deux langues étrangères. Ces tables de Wachsmann auront le double avantage de les renseigner au besoin sur la physique des radiations et en même temps de les familiariser avec des expressions techniques dont la traduction est souvent difficile à obtenir. Et dans ce domaine, le manuel de Wachsmann et Dimotsis vient combler une autre lacune.

G. P.

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